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Progress Report

Period of 12/15/61 to 1/15/62

Contract No. AF33(600)40280

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Flight Test

Summary

A. General

Approximately 85% of the overall installation modifications are complete.

The AN/APQ-93 system was delivered to Test and Evaluation on December 31, 1961 and power was first applied to the aircraft-system on January 9, 1962. There were no apparent wiring or systems electrical discrepancies in the "standby" mode.

Status of the modifications is:

(a) Rotary Armament Door - 80% complete.

(b) Nose installation (Instrumentation) 95% complete.

(c) Cockpits - 90% complete.

(d) Radomes - Both APQ-93 and APN-102 have been received.

(e) Antenna Pod and Strut is 75% complete.

(f) Overall aircraft wiring is 90% complete.

B. Auxiliary and Ground Support Equipment

All known spares requirements have been submitted and approximately 85% of the items requested have been received.

Delivery of the modified AN/APN-102 indicator will be delayed until January 25, 1962. A GPL representative will bring the indicator and check out the entire APN-102 system and ASN-25 system.

C. Instrumentation

All instrumentation units, except the Signal Conditioners, have been tested in the aircraft installation and function properly. The Signal conditioner is in fabrication and is 90% complete.

Circuitry is being developed to monitor antenna pod flutter conditions on the first two pod flights.

D. Schedule

January 27 - Complete all aircraft systems test.

February 1 - Complete aircraft installation inspection for flight.

February 5 - Complete pilot proficiency flights (three flights).

February 7 - Complete pod flutter flight tests.

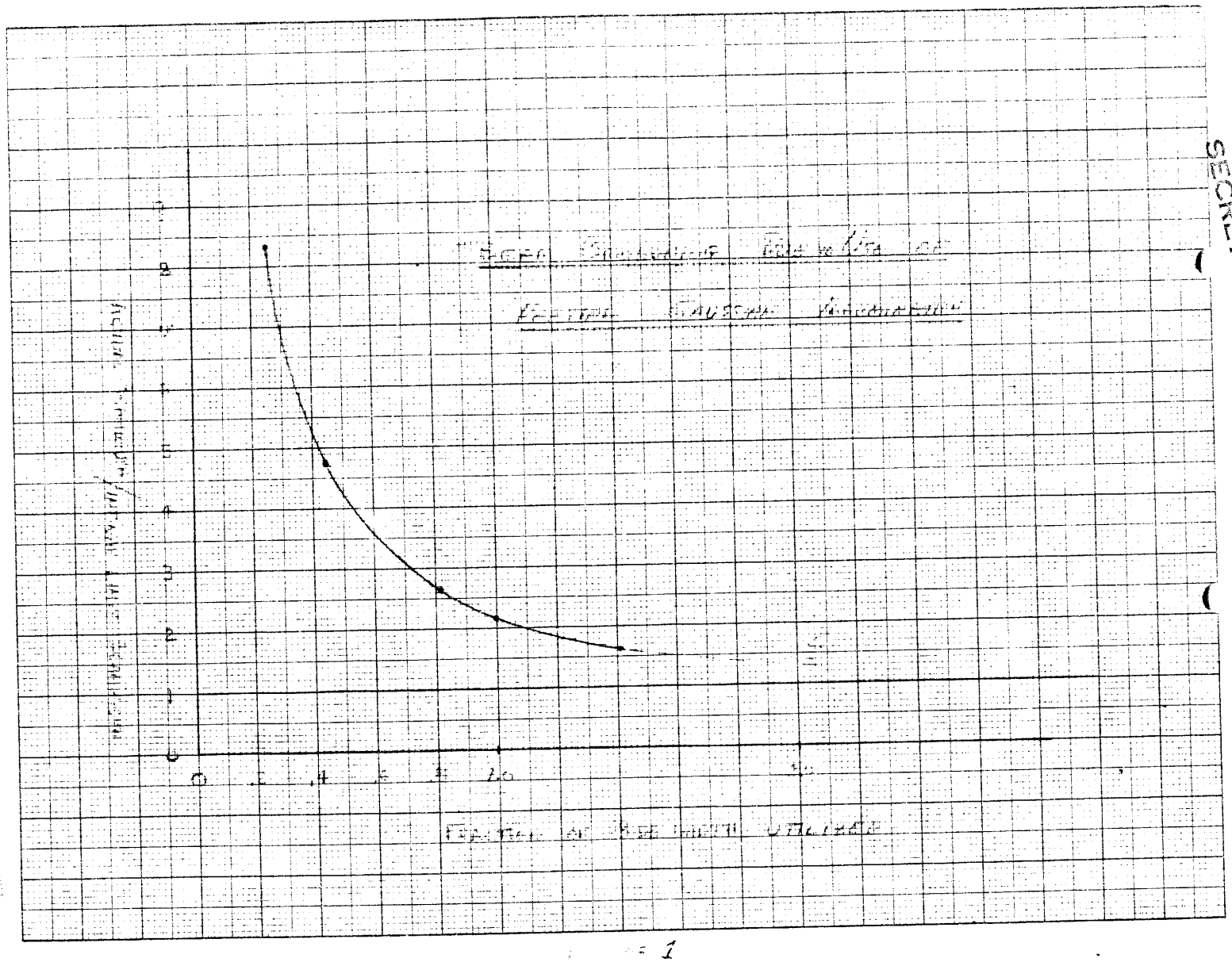
February 12 - Commence APQ-93 system flight tests.

System

Work was done on the effect of limiting the signal history. While no exact analytical solution was found, an approximate solution for the "beamwidth" of the synthetic antenna has been found using the aperture moment method. Figure 1 shows the result of this method, accurate to 5-10%.

Detailed investigation of the possibility of modifying the antenna alignment to permit use of the entire 11 foot antenna within the prescribed volume have been carried out, and the results forwarded for mechanical feasibility investigation. This approach looks quite promising.

A study of the system weight and ways of reducing same, has been run. Estimates show that by an all-out effort as much as 200 lbs. might be shaved off the present 782 lb. weight.



Antenna

Fabrication and Flight Test Antenna

Beams: Beams number 1 and 2 have been inspected and accepted following alteration. Beam number 3, following further analysis, has been accepted.

Manifolds: A total of seven manifolds have been received to date. Six of these - a full complement for the flight test antenna - have satisfactorily passed all dimensional and electrical checks and have been assembled into modules for the flight test antenna. The seventh manifold is currently being electrically tested.

The eight manifolds required for antenna number 2 (making a total of fourteen) have been promised by January 22.

Array Sticks: A full set of 96 sticks for the flight test antenna has been sealed and assembled into modules. An additional quantity of 97 sticks has been machined to date by the Air Arm Model Shop and transported to Gar to be finished. A full complement of 128 sticks for antenna number 2 (making a total of 224) has been promised by January 22.

Modules: The six modules required for the flight test antenna have been "grown together" and assembled to the flight test beam.

The process of electroforming sticks and manifolds into integral modules has progressed satisfactorily. It was found that the electroforming joining process had to be performed at a somewhat slower growth rate than was first anticipated to avoid porosity and excessive "tree" build-up. Residual air leakage had to be corrected in a few cases by application of high temperature solder, gallium-gold amalgam, or EC-1663 high temperature adhesive.

Power Dividers: A complete set of seven power dividers for the flight test antenna has been received, tested, and assembled into the flight test beam. Phasing measurements indicated that three of the power dividers required a counterclockwise twist rather than a clockwise twist to give the proper phase distribution for the array. This modification was made and the power dividers were reassembled. Results of phase measurements indicated desirability of incorporating phase shifters for "trimming" purposes in succeeding antennas; this is being done.

Barriers: A complete set of barriers has been received for the flight test antenna. These have been assembled temporarily to the flight test antenna; however a number of helicoil inserts require replacement before final assembly. This work is in progress.

Flight Test Antenna: Radiation pattern and gain measurements are in progress on the flight test antenna. Preliminary results indicate that performance of this antenna will be adequate for the flight test program.

Duplexer

Modifications to accept covers for the dump switches have been completed on units 1, 2 and 3.

Performance of the new switch from EGG was satisfactory in composite tests of system #2.

Measurements will be made during the next reporting period to determine duplexer parameters such as, unfired insertion loss, fired arc loss and recovery time, both for low and high power.

It is expected that the "tail bite" switch (missing in unit #2) will be available during the week of January 14, 1962.

Covers for the "tail bite" and "dump switches" are being redesigned with a view toward switch accessibility and R.I. shielding.

Duplexer Driver

Drivers #1 and #2 are complete and have been inspected.

Driver #3 has been electrically and mechanically inspected and is now in test.

Modifications to supply "tail bite" pulse and "sweeping voltage" are complete.

Power Monitor

Units #1 and #2 have been inspected and installed in the systems.

Unit #3 is ready for inspection.

Switch Tubes

Major effort has been spent in fabricating and testing the WX-4641 waveguide switch tube. A tube has been constructed in large X waveguide. The isolation of this switch is approximately 6 db and further work is being done to improve this parameter. The tube must also be redesigned for small X waveguide.

The first tube in large X waveguide is to be delivered to the project group on January 17, 1962 and it is anticipated a second model will be ready by January 23, 1962.

A WX-4554 dump switch is also being fabricated. This tube has not been tested as yet but is expected to be evaluated this week.

Modulator

#1 modulator is now in Flight Test, #2 is in system test and #3 is nearing completion.

The newly designed PFN-pulse transformer is satisfactory and delivery of three units is expected in a few days. These units will be incorporated in the above modulators.

Receiver

TWT

The first TWT is in Flight Test and the second is in composite test. Assembly of the third TWT is now in process.

Design of a filter box for the TWT power leads has been completed, however, all the filter capacitors have not as yet been received. Upon delivery of these components, the filters will be back fitted to the TWT assemblies.

I.F. Amplifier

All three units are complete and have been tested.

Video Amplifier

All three units are complete and have been tested.

Synchronizer

Synchronizer Generator

Two units have been reworked to increase the delay for the gated 120 M.C. gate. (Ref. December 15 report.)

Rework on the third unit is now being done.

All units have proven to be satisfactory in composite testing.

Frequency Generator

Units for systems #1 and #2 have been checked out using the interim Bulova oscillator-discriminators.

The Bulova oscillator output difficulty has been corrected by employing an amplifier stage in the microwave unit as buffer for the oscillator output.

Oscillator-discriminator units incorporating this correction are scheduled for delivery as follows:

1	ON	Feb. 1, 1962
2	ON	Feb. 15, 1962

Stalo and Receiver

Unit #3 has been unit tested and returned to the shop for installation of the new crossguide coupler which incorporates an additional arm with a co-ax adapter for test purposes. (Ref. November 15 report.)

Unit #1 is being used in composite test and will be modified in the above manner following completion of Unit #3.

Unit #2 is being used with the system scheduled for flight testing.

Recorder

General

Acceptance test for Recorder #1 was held this month and upon completion delivery of the recorder was accepted by Westinghouse.

Work has started on the design of a "conventional optics imaging recorder" as per the proposal submitted during the month of November 1961.

Fabrication of recorders two and three has been completed and assembly of number two started.

Electrical

A two ampere fuse in series with the 28 volt input power connection to the high voltage power supply has been added to protect the power supply.

Assembly of electronic package for #3 recorder is nearing completion. Debugging of the package for #2 is progressing.

Cabling of #2 recorder has been completed.

Three inverters failed upon installation. Investigation is underway to determine the cause.

Conventional Optics Recorder

Design of this recorder has progressed on schedule.

Relocation of all components as in progress with an overall increase in the length of the recorder of approximately 6".

Design and detailing of several optical assemblies has been completed using invar as the mounting material.

Design is in process on the outside cover to enable removal of the two long sides for servicing.

The order for the invar was placed early this month, since the lead time for this material is 6 to 8 weeks. Two CRT's were placed on order. These will be a 1 mil spot size tube with a ½" thick faceplate.

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A visit was made to [redacted] to obtain performance data of the lenses to be used. Effects of temperature changes were discussed and these effects will be determined experimentally after the lenses are completed. Pressure differentials across the elements due to an unvented lens operating under 4.8 psi conditions are expected to have negligible effect.

Fiber Optics

Some progress has been realized during the report period towards the development of a satisfactory fiber optic unfolding array. Samples of a rectangular multi-fiber bundle were supplied by [redacted] 25X1
This multi-fiber, on visual microscopic inspection, resolved 114 line/mm with little geometric distortion. The manufacturer is fabricating a 4.5 by 8 inch sheet of these multi-fibers for further evaluation. His initial attempt at this fabrication was spoiled by breakage of the fibers during the annealing process.

An unfolding array fabricated b[redacted] as 25X1
received during the report period. This array, on visual inspection, showed a resolution of 37 l/mm limiting. The geometry of the reproduced image of a straight line is excellent.

Cathode Ray Tube

The acquisition of a CRT with a 0.5 mil spot continues to be a problem. Continually reoccurring electron gun problems in the WX-4431 (0.5 mil) tube necessitated rescheduling the tube back to the study phase. There is now no scheduled date for delivery of a 0.5 mil tube.

In order to minimize environmental problems with the faceplate of the cathode ray tubes it was decided to increase the thickness to 0.5 inches.

Film

We have continued to study the sensitometric problems in selecting film for both the fiber optic and the lens recorders. A report on one phase of this study, entitled "Comparison of Several Films When Exposed to Simulated P-11 Phosphor Illumination" is appended.

Navigation Tie-In

The D.C. bias which was originally to be supplied by the navigation system is now to be provided in the Nav Tie-In Units. This supply is being added to each unit along with test connections which were originally to be provided for Flight Test only.

Power Supply and Control Panel

Power Supply #2 is complete and has been installed in the Flight Test System.

Power Supply #1 is in the second system which is now in composite test.

Power Supply #3 is in unit test.

Frame (Electric)

Frame #3 is now in the final wiring stage.

Frame (Mechanical)

Frame #3 has been completed.

Truss

Same as last period.

Stress Analysis

Same as last period.

Unit Test Cables

Cables for System #3 are 95% complete.

Cable for System #1 is now in the Model Shop to be brought up to date for System #1 when it is returned from flight testing.

System Handling Equipment

The third system test cart has been completed.

Composite Test

System #001 was delivered on December 29, 1961 less the antenna and with functional exceptions to the Recorder, Modulator, and Duplexer. The units with exceptions were complete electrically, but contained components which were experimental breadboard models and will be changed when the developmental components are available. The following exceptions were noted:

1. Recorder #1
   a) The high voltage power supply is a breadboard unit.
   b) A one (1) mil spot size cathode ray tube is used pending the development of a $\frac{1}{2}$ mil spot size tube.
   c) An experimental model of the fiber optics is cracked.
   d) The auxiliary data recorder is not included but is not required in the (W) Flight Test Program.
2. Modulator #1. The pulse transformer-pulse forming network unit now installed does not meet the specified ripple requirements.
3. Duplexer #1. An experimental ring dump switch is installed.

The recorder has been shipped back to the subcontractor for rework to install components suitable for use with the Flight Test Program. It is expected to be returned to Westinghouse by 2 February.

System #2 is in composite test. The transmitter and receiver chains have been checked out and targets have been observed with a horn antenna. Approximately one third of the units are complete and have been inspected. The remaining units are in the process of unit test and inspection.

Spares

All purchase orders have been placed for components and manufacturing parts.

Test Equipment

Composite Test Equipment

There has been no work performed on this aspect of the job during this period.

Design Evaluation Equipment

The design, breadboarding, test and fabrication is progressing within the predicted schedule. Although some technical problems exist the major problem which seems to threaten the schedule is delivery of purchased parts.

Delivery by February 1 of some portion of the test equipment is a certainty. The major portion will be available during the next reporting period and a small portion will not be ready for delivery before March 1.

The problems and areas of progress will be detailed in the following paragraphs.

Transponder

All of the purchased parts except the precision attenuators have been received from the suppliers. The layout has been completed and assembly of the package has begun. This unit should be available by February 1.

Clutter Generator

The final package of the Gate and Gate Control circuits has been built and tested in conjunction with the noise source. The combination operates as anticipated and will operate satisfactorily in the completed equipment.

The sampling frequency generator, which determines the sampling rate to the low frequency output, has been designed, breadboarded, tested and incorporated into the final package. The low frequency output, which is a band of frequencies from D.C. to approximately 15 cps, appears to be proper. All checks which can be made, with the test equipment on hand, indicates that operation is proper. However, a reliable and accurate evaluation cannot be made until the Lf-2B subsonic analyzer, ordered by the lab, has been received. The delivery date of this equipment has been moved from February 1 to March 9.

The design and construction of the antenna pattern filter has been placed in the component group. Crystal filters will be used. The completed filter will be delivered by January 29, 1962. This filter is identical to the one which will be used in the Azimuth Resolution Test Pattern Generator. The Clutter Generator is 80% complete. This unit should be available by February 1.

Range Resolution Test Pattern Generator

The final configuration in the final package has been fabricated and is being tested. The complete package is working satisfactorily. The pulse repetition rate is variable from 25 KC to 95 KC. The pulse width is 10 nanoseconds.

The pulse shape at the output was checked by modulating an X-band signal with the pulse and then observing the detected envelope of the X-band carrier.

The portion of the chassis which will control the ferrite attenuator during the dynamic range check is being breadboarded and tested. The stepping switch for this function has not been delivered by the outside supplier.

This chassis is approximately 80% complete.

This unit should be available by February 1.

Azimuth Resolution Test Pattern Generator

The Tachometer, Tachometer Amplifier, Pulse position modulator and motor drive amplifier have been fabricated in the final package. They have been tied together as a complete package and operate satisfactorily as an integral package.

The layout of the servo is complete. All of the piece parts have been received from the Model Shop. Assembly of the servo has begun. However, completion of this assembly cannot be accomplished as several gears have not been received as yet from outside suppliers. This prevents testing of the above equipment with the loop closed.

The final configuration of the divider chain and the final configuration of the multiplier chain have been tested and operate satisfactorily as a unit. The final chassis on which these modules will be mounted has been constructed.

The antenna pattern filter is being constructed as noted above. It will be available for incorporation into this unit by January 29, 1962. A problem may exist due to the possibility that some ringing may occur following the main lobe pattern.

Such ringing would be caused by the high "Q" which is necessary and the necessity of sweeping thru the frequency band which the filter covers. It is felt, however, that the ringing will be so far down from the main lobe that it will be lost in the noise. However if the ringing does alter the shape of the output slightly it will still more nearly approach the antenna pattern shape than a simple "gate on" - "gate off" scheme (square lobe pattern) that would be used without the filter.

Fabrication of the final package of the various mixers is complete and at present they are being tested.

The range delay circuit, which must be a jitter free circuit, has not been built as yet but two techniques are being considered. Some difficulty may be encountered in obtaining a pulse that falls within the jitter tolerances involved. However, the circuits being considered show promise in this regard.

The single sideband filters were received 1/15/62 and have been incorporated into the system. No information regarding the compatibility of their operation in the system is available at this writing. However, the filter characteristics are as specified and no problems are anticipated.

The R.F. calibration signal generator has been designed, fabricated in the final package and tested. Satisfactory results have been obtained.

The mechanization of the goniometer drive is such that if either the control motor or the bias motor should fail to rotate at the appropriate speed the goniometer would rotate in excess of 500 RPM which is its maximum allowable speed. Therefore, it has been necessary to add some circuitry that will sense this rotation and shut down the servo if the maximum speed is exceeded. The sensing circuit and the relay driver circuit to accomplish this have been designed but have not yet been built and tested.

This unit is 75% complete.

Azimuth Resolution Optics Assembly

The spherical mirror has been received from the supplier. All optical parts are now on hand.

A breadboard of the optical setup is now being constructed in the lab.

Some problem may exist due to the very low intensity of light available after it has passed thru the film. Considerable effort has been expended to obtain the maximum light intensity without resorting to a "brute force" solution such as an arc lamp. Whether a problem exists or not will actually be known only after a piece of film has been viewed in the device. The layout of the optics has been completed.

Detail drawings were being made and released to the Model Shop.

Range Resolution and Dynamic Range Optics Assembly

The layout has been completed. All of the details will be completed and released to the Model Shop during the week ending 1/21/62. All of the piece parts for the lower optics are already on hand and are available for assembly. Some of the piece parts for the upper optics have been received from the Model Shop. Assembly of these parts has been started.

This unit is 70% complete. This unit will be delivered during the next reporting period.

Film Evaluator Electronic Circuitry

The final package of the high voltage power supply and the lamp supply have been built, tested OK and are available for use in the unit which will be delivered. These units are common to both the Range and Azimuth optic assemblies.

The units stage of the counter circuit has been completed in the final package. The units to tens transfer circuitry and the tens stage of the counter have been breadboarded and are being tested.

The photo diode reset circuitry has been breadboarded and checked out satisfactorily. The counter and photo diode reset are for use in the Range Resolution optics.

The final configuration of the chassis which will hold the modules has been fabricated and is ready for use.

Mechanical Design and Packaging

All power supplies have been ordered and will be available no later than February 1. The racks have been ordered and will be received January 23, 1962.

The power distribution system and the cooling air distribution have been designed. The interconnection cabling is being tabulated in preparation for wiring the cabinet. The details of the overall cabinet layout are being developed but are not complete as yet.

Doppler Frequency Tracker

During this period, the initial analysis phase of this task ended and the design of the sub-units was started.

The second IF single side band filter has been designed, breadboarded and tested. Its performance is satisfactory. The booster amplifier, which provides most of the gain in the tracker, has been designed and will be built shortly. Tentative design has been done on the low frequency filters for the system and parts have been ordered.

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APPENDIX

PHOTOGRAPHY DEPARTMENT

Test Report

Project 9134.01E1

Comparison of Several Films when Exposed to Simulated P-11 Phosphor Illumination

15 December 1961

by

25X1

[redacted]

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25X1

Approved [redacted]

Approved

Introduction

25X1

At the request of the Electronics Department, the characteristics of 10 different films were determined for exposures to simulated P-11 phosphor illumination. Films evaluated were E.K. 5374 (TV Recording Film), E.K. SO-130 (Aero Pan-X), E.K. 30-52647, E.K. Electrocardiograph, [redacted], E.K. SO-102 (Aero Plux-X), E.K. SO-243, E.K. 5427, and E.K. Tri-X Pan. The object of this investigation was to find a film which has better than 8 times the speed of 5374 when exposed to the illumination of a CRT coated with P-11 phosphor. The spectral-energy emission curve for the P-11 phosphor extends from about 400 mμ to 550 mμ with a sharp peak at 460mμ. 25X1

The maximum high (1000:1) and low (2:1) contrast resolving power capabilities of 5374 and the two fastest materials tested (SO-102 and Tri-X pan) were also determined to indicate how much of a resolution sacrifice must be made in order to achieve sufficient sensitivity.

NOTE: Due to stringent scheduling requirements the sensitometric evaluations were made from only one strip of each material. The results, therefore, should only be used to give indications and not as absolute values.

Itek

P[illegible]ography Department

Research and Professional Division

Sub-Project No. [illegible]

Sub-Project Title Film Evaluation

Date 15 December 1961

Prepared By [redacted] 25X1

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25X1

TEST REPORT

PERSONNEL [redacted]

TEST DATE Dec. 4-13, 1961

DESCRIPTION OF TEST Speed Comparison of Several Films when Exposed to Simulated P-11 Phosphor Illumination

MATERIAL/APPARATUS UNDER TEST E.K. films 5374, Electrocardiograph, 30-52647, SO-130, SO-102, E.K. TRI-X pan, [redacted] E.K. 5427, & E.K. SO-243. 25X1

TEST EQUIPMENT E.G& G Mark VI Sensitometer, MacBeth-Ansco Model 12A Densitometer, Thermos agitator, Itek Resolving Power Test Camera - Model II. B & L binocular microscope

PROCEDURE

1. One strip of each film type was exposed in the EG&G sensitometer through a Wratten #48 filter for 0.001 sec. The exposing illumination simulates that produced by P-11 phosphor.
2. All strips were processed in D-19 for 6 min at 68°F using the thermos agitator.
3. The densities of the processed strips were read on the densitometer and used to plot D log E curves.
4. From these curves the speeds of each film, relative to 5374, were determined.
5. Both high (1000:1) and low (2:1) contrast resolving power exposures were made on 5374, SO-102, and TRI-X Pan in the resolving power camera using simulated P-11 phosphor illumination.
6. Resolving power exposures were made in exposure increments of 0.2 log E. Five replicate exposures were made at each setting. The 16mm objective (reduction: 200X) was used for the high contrast exposures and the 25mm objective (reduction: 55.7X) was used for the low contrast exposures.
7. The resolving power strips were processed in D-19 for 6 min at 68°F using the thermos agitator.
8. The maximum resolving powers at both contrast levels were determined using a B&L binocular microscope with substage condenser and simulated daylight illumination. The maximum value was determined using the proposed ASA method, i.e., the three highest readings in a group of five readings determines the resolving power value.

RESULTS*

Tri-X Pan was the only film tested that produced an 8X speed increase over 5374. Tri-X Pan is approximately 30 times faster (5 f/stops) faster than 5374, however the fog level (0.34) is sufficiently high to be considered detrimental. SO-102, the next fastest material, was 4.4 times faster than 5374. However, with forced processing the speed of this film can probably be doubled, a factor which should be considered. [redacted] Ilford BY, E.K. Electrocardiographic, E.K. 30-52647, and E.K. SO-130 ranged from 1.7 to 2.7 (1 to 1-1/2 f stops) faster than 5374. E.K. 5427 and E.K. SO-243 were respectively 1 and 3 f-stops slower than the 5374. The characteristic curves for the 10 films are shown in figures 1-4. The speeds relative to 5374 are listed in Table I. The speed comparisons were made by taking the differences in exposure necessary to produce a density of 0.60 - a reasonable criteria for the particular system under consideration. 25X1

The results of the resolution tests (listed in Table II.) show the sacrifice that must be made in order to use the higher speed films. SO-102 has only 65% of the high contrast and 42% of the low contrast resolving power of 5374. The high contrast resolution of Tri-X Pan is only 48% of 5374 and the low contrast resolution is only 37%.

* See Attached Graphs, Data Sheets, and/or Sketches.

Table I

Film	Speed Relative to E.K. 5374 (at Density = 0.6)
E.K. SO-243	.13
E.K. 5427	.5
E.K. 5374	1
E.K. SO-130	1.7
E.K. 30-52647	1.9
E.K. Electrocardiograph	2.1
Ilford BY	2.3
[redacted]	2.7
E.K. SO-102	4.4
E.K. Tri-X Pan	30.0

25X1

Table II

	Resolving Power (lines/mm)	
Film	Target Contrast 1000:1	Target Contrast 2:1
E.K. 5374	178	105
E.K. SO-102	112	44
E.K. Tri-X Pan	89	39

DATE 5 DEC 61 STEP N

PROJECT 9134.01E1 25X1

PREPA

1 FILM (TYPE) AS NOTED

EMUL. NO.

EXPIR. DATE

EXPOS. TIME 0.001 SEC - EGG

FILTER ATTEN. + W#48

LAMP NO.

DEV.	TIME	TEMP.	AGIT.
D-19	6'	68°F	T-A

2 FILM (TYPE)

EMUL. NO.

EXPIR. DATE

EXPOS. TIME

FILTER

LAMP NO.

DEV.	TIME	TEMP.	AGIT.

3 FILM (TYPE)

EMUL. NO.

EXPIR. DATE

EXPOS. TIME

FILTER

LAMP NO.

DEV.	TIME	TEMP.	AGIT.

VAR.	SPEED	FOG	GAMMA
1		.06	2.45
2		.06	2.02
3		.03	2.80
4		.05	2.14
5		.07	1.95
6		.10	1.63

FIG. 1

E.K. ELECTROCARDIOGRAPH ①

SO-130 ②

E.K. 5374 ③

E.K. 30-52647 ④

⑤ 25X1

ILFORD BY ⑥

DENSITY

RELATIVE LOG EXPOSURE

3.73 ABSOLUTE LOG E

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-24-

DATE 6DEC61 STEP NO.
PROJECT 9134.01E 25X1
PREPARED BY
1 FILM (TYPE) AS NOTED
EMUL. NO.
EXPIR. DATE
EXPOS. TIME 0.001sec, EGG
FILTER ATTEN. + W#48
LAMP NO.

DEV.	TIME	TEMP.	AGIT.

2 FILM (TYPE)
EMUL. NO.
EXPIR. DATE
EXPOS. TIME
FILTER
LAMP NO.

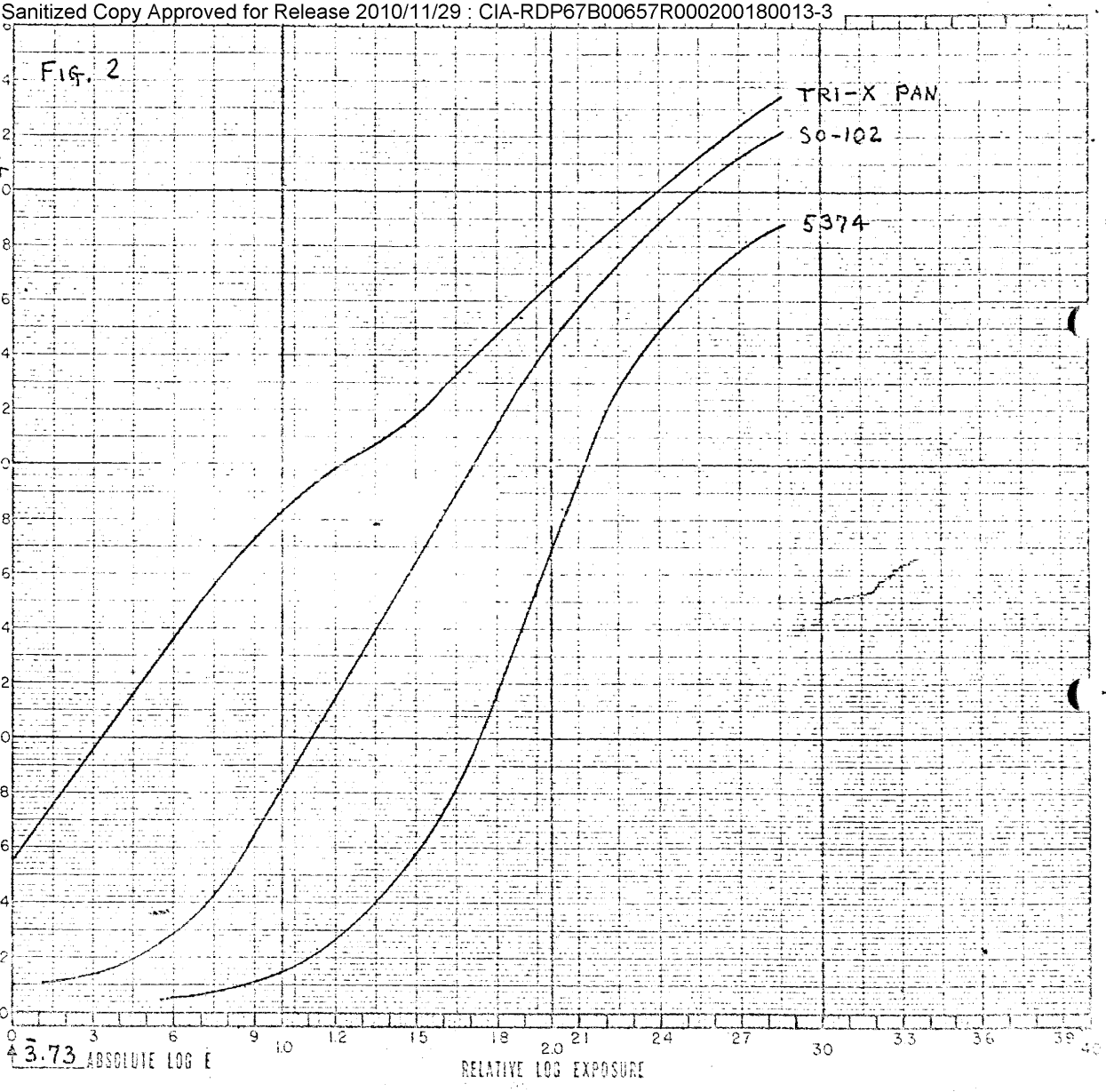
DEV.	TIME	TEMP.	AGIT.

3 FILM (TYPE)
EMUL. NO.
EXPIR. DATE
EXPOS. TIME
FILTER
LAMP NO.

DEV.	TIME	TEMP.	AGIT.

VAR.	SPEED	FOG	GAMMA
5374		.03	2.62
SO-102		.09	1.69
TRI-X		.04	1.38

FIG. 2



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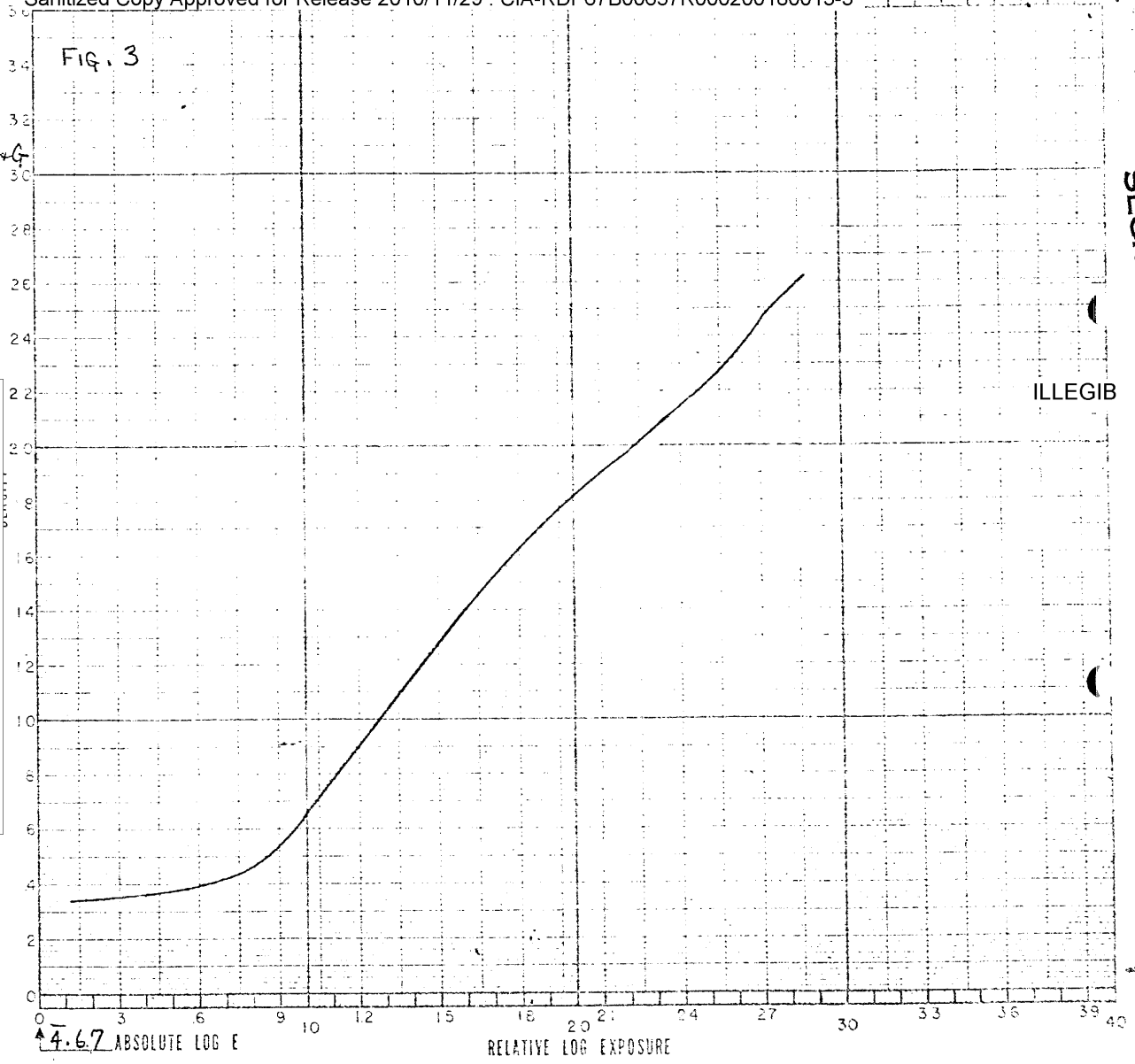
DATE 6 DEC 61 STEP NO
PROJECT 9134.01E1 25X1
PREPARED B
FILM (TYPE) TRI-X PAN
EMUL NO
EXPIR DATE
EXPOS TIME 0.001 SEC - EG+G
FILTER ATTEN + W #48
LAMP NO

DEV	TIME	TEMP	AGIT
D-19	6'	68°F	T-A

VAR	SPEED	FOG	GAMMA
		0.34	1.26

FIG. 3



ILLEGIB

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SENSITOMETRIC DATA SHEET

DATE 13 DEC 61 STEP
PROJECT 9134.01E1 25X1
PREPARED
FILM (TYPE) AS NOTED
EMUL. NO.
EXPIR. DATE
EXPOS. TIME 0.01 SEC - EGG
FILTER ATTEN + W#48
LAMP NO.

DEV	TIME	TEMP	AGIT
D-19	6'	68°F	T-A

FIG. 4

5427

5374

SO-243

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ILLEGIB

-27-

	SPEED	FOG	GAMMA
SO-243		0.24	3.00
5427		0.04	3.33
5374		0.04	2.50

3.73 ABSOLUTE LOG E

RELATIVE LOG EXPOSURE